Installation & Operation Manual

3204
1/32 DIN Autotune Temperature Controller

Chromalox®
PRECISION HEAT AND CONTROL

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Safety and Warranty Information

Installation

Designed for use:

UL873 - only in products where the acceptability is determined by Underwriters Laboratories Inc.

EN61010-1 - within installation Categories II and III environment and pollution degree 2.

To avoid possible hazards accessible conductive parts of final installation should be protectively earthed in accordance with EN61010 for Class 1 equipment. Output wiring should be within a grounded cabinet. Sensor sheaths should be bonded to ground or not be accessible.

Live parts should not be accessible without use of a tool. It is the responsibility of the installation engineer to ensure that this equipment's compliance to EN61010 is not impaired when fitted to the final installation and to use this equipment as specified in this manual, failure to do so may impair the protection provided.

Ensure the installation is in compliance with appropriate wiring regulations.

Configuration

All functions are front selectable, it is the responsibility of the installing engineer to ensure that the configuration is safe. Use the program lock to protect critical functions from tampering.

Ultimate Safety Alarms

Do not use SP2 as the sole alarm where personal injury or damage may be caused by equipment failure.

Warranty and Returns Statement

These products are sold by Chromalox under the warranties set forth in the following paragraphs. Such warranties are extended only with respect to a purchase of these products, as new merchandise, directly from Chromalox or from a Chromalox distributor, representative or reseller and are extended only to the first buyer thereof who purchases them other than for the purpose of resale.

Warranty

These products are warranted to be free from functional defects in material and workmanship at the time the products leave Chromalox factory and to conform at that time to the specifications set forth in the relevant C instruction manuals sheet or sheets, for such products for a period of three years.

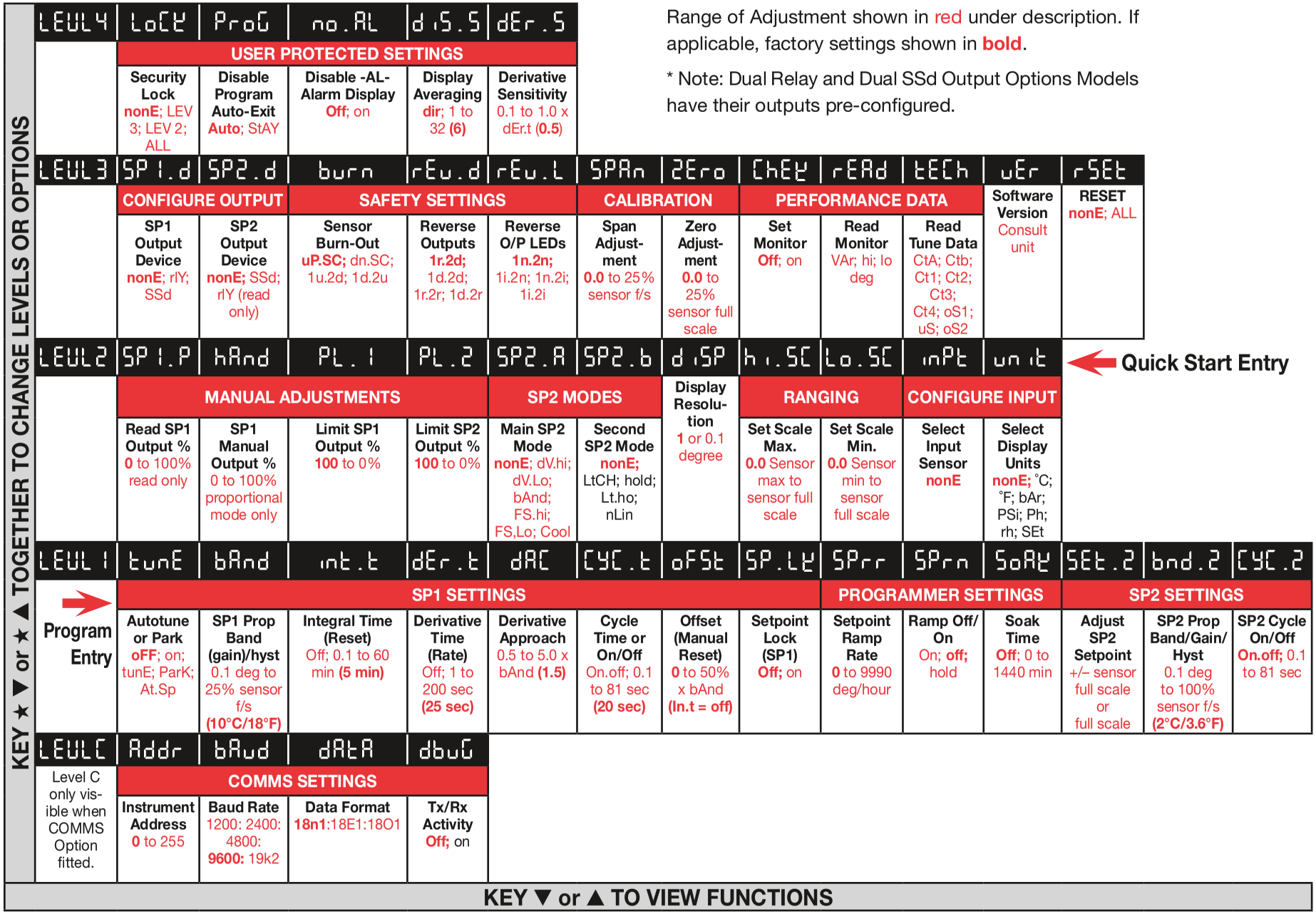
THERE ARE NO EXPRESSED OR IMPLIED WARRANTIES, WHICH EXTEND BEYOND THE WARRANTIES HEREIN AND ABOVE SET FORTH. CHROMALOX MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE PRODUCTS.

Limitations

Chromalox shall not be liable for any incidental damages, consequential damages, special damages, or any other damages, costs or expenses excepting only the cost or expense of repair or replacement as described above. Products must be installed and maintained in accordance with Chromalox instructions. There is no warranty against damage to the product resulting from corrosion. Users are responsible for the suitability of the products to their application.

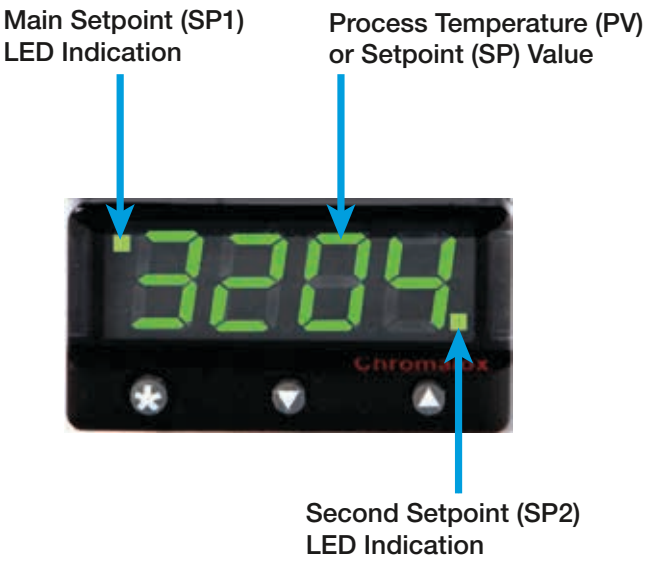
For a valid warranty claim, the product must be returned carriage paid to the supplier within the warranty period. The product must be properly packaged to avoid damage from electrostatic discharge or other forms of harm during transit.

Functions Menu


KEY ★ ▼ or ★ ▲ TOGETHER TO CHANGE LEVELS OR OPTIONS
LEUL4 LoCE ProG no.AL d.S.S dEr.S
USER PROTECTED SETTINGS
Security Lock nonE; LEV 3; LEV 2; ALL
Disable Program Auto-Exit Auto; StAY
Disable -AL- Alarm Display Off; on
Display Averaging dir; 1 to 32 (6)
Derivative Sensitivity 0.1 to 1.0 x dEr.t (0.5)
LEUL3 SP1.d SP2.d burn rEu.d rEu.L SPAn 2Ero ChEY rEAd tECh uEr rSEt
CONFIGURE OUTPUT
SAFETY SETTINGS
CALIBRATION
PERFORMANCE DATA
SP1 Output Device nonE; rlY; SSd
SP2 Output Device nonE; SSd; rlY (read only)
Sensor Burn-Out uP.SC; dn.SC; 1u.2d; 1d.2u
Reverse Outputs 1r.2d; 1d.2d; 1r.2r; 1d.2r
Reverse O/P LEDs 1n.2n; 1n.2i; 1i.2n; 1i.2i
Span Adjust-ment 0.0 to 25% sensor f/s
Zero Adjust-ment 0.0 to 25% sensor full scale
Set Monitor Off; on
Read Monitor VAr; hi; lo deg
Read Tune Data CtA; Ctb; Ct1; Ct2; Ct3; Ct4; oS1; uS; oS2
Software Version Consult unit
RESET nonE; ALL
LEUL2 SP1.P hAnd PL.1 PL.2 SP2.A SP2.b d.SP h.SC Lo.SC inPt unit
Quick Start Entry
MANUAL ADJUSTMENTS
SP2 MODES
RANGING
CONFIGURE INPUT
Read SP1 Output % 0 to 100% read only
SP1 Manual Output % 0 to 100% proportional mode only
Limit SP1 Output % 100 to 0%
Limit SP2 Output % 100 to 0%
Main SP2 Mode nonE; dV.hi; dV.Lo; bAnd; FS.hi; FS,Lo; Cool
Second SP2 Mode nonE; LtCH; hold; Lt.ho; nLin
Display Resolu-tion 1 or 0.1 degree
Set Scale Max. 0.0 Sensor max to sensor full scale
Set Scale Min. 0.0 Sensor min to sensor full scale
Select Input Sensor nonE
Select Display Units nonE; °C; °F; bAr; PSi; Ph; rh; SEt
LEUL1 tunE bAnd int.t dEr.t dAC CYC.t oFSt SP.LY SPrr SPrn SoAY SEt.2 bnd.2 CYC.2
Program Entry
SP1 SETTINGS
PROGRAMMER SETTINGS
SP2 SETTINGS
Autotune or Park oFF; on; tunE; ParK; At.Sp
SP1 Prop Band (gain)/hyst 0.1 deg to 25% sensor f/s (10°C/18°F)
Integral Time (Reset) Off; 0.1 to 60 min (5 min)
Derivative Time (Rate) Off; 1 to 200 sec (25 sec)
Derivative Approach 0.5 to 5.0 x bAnd (1.5)
Cycle Time or On/Off On.off; 0.1 to 81 sec (20 sec)
Offset (Manual Reset) 0 to 50% x bAnd (In.t = off)
Setpoint Lock (SP1) Off; on
Setpoint Ramp Rate 0 to 9990 deg/hour
Ramp Off/On On; off; hold
Soak Time Off; 0 to 1440 min
Adjust SP2 Setpoint +/– sensor full scale or full scale
SP2 Prop Band/Gain/Hyst 0.1 deg to 100% sensor f/s (2°C/3.6°F)
SP2 Cycle On/Off On.off; 0.1 to 81 sec
LEULC Addr bAud dAtA dbuG
Level C only vis-ible when COMMS Option fitted.
COMMS SETTINGS
Instrument Address 0 to 255
Baud Rate 1200: 2400: 4800: 9600: 19k2
Data Format 18n1:18E1:18O1
Tx/Rx Activity Off; on
KEY ▼ or ▲ TO VIEW FUNCTIONS

Range of Adjustment shown in red under description. If applicable, factory settings shown in **bold**.

* Note: Dual Relay and Dual SSd Output Options Models have their outputs pre-configured.



INSTRUMENT ADJUSTMENTS

To enter or exit **program mode:**	Press ▲ ▼ together for 3 seconds
To scroll through **functions**:	Press ▲ or ▼
To change **levels** or **options**:	Press ★ ▲ together or ★ ▼ together
To view setpoint:	Press ★
To increase setpoint:	Press ★ ▲ together
To decrease setpoint:	Press ★ ▼ together
To reset an alarm or fault condition:	Press ▲ ▼ together briefly

Notes: If experiencing difficulty by becoming “lost” in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the INSTRUMENT ADJUSTMENTS above and try again.

When in program mode, after 60 seconds of key inactivity the display will revert to either inPt ***nonE*** or, if the initial configuration has been completed, the measured value. Any settings already completed will be retained.

Quick Start

After power-up the controller requires programming with the following information:

- **Type of Sensor**
- **Operating unit**
- **Allocation of Output Device to SP1/SP2 (Relay or SSd)**
- **Temperature Setpoint** eg. Degrees

When the above information has been programmed into the controller it will be operational with the following factory settings.

Proportional band/Gain	10ºC/18ºF
Integral time/Reset	5 mins
Derivative time/Rate	25 secs
Proportional cycle-time (Typical setting for relay output)	20 secs
DAC Derivative approach control (Average setting for min. overshoot)	1.5

TIP: Please note that in this manual, the functions are reversed out from a black background and the options are shown in bold italic:
eg. tunE and ***ParK***

Note: In this manual the letter k is represented by the character ᴋ

Note: During the following procedure the display will revert to alternating inPt and ***nonE*** after 60 seconds of key inactivity, but will retain any settings already completed. Should this occur, or in the event of becoming 'lost' in the program, please start again from the alternating inPt and ***nonE*** display.

Quick Start Set-Up

On power-up the controller will display the self test sequence followed by alternating inPt and ***nonE***

1. **Select input sensor**
   Press and hold ★ and use the ▲ or ▼ buttons to scroll through the sensor selection list until the correct sensor is displayed. Release the buttons.
   The display now alternates selected sensor type (eg. inPt and ***Tc.S***)

   Press ▲ once. The display will now alternate unit and ***nonE***

2. **Select unit.**
   Press and hold ★ and use the ▲ or ▼ buttons to scroll through the unit selection list until the correct unit is displayed.
   Release the buttons. The display will now alternate selected unit (eg. unit and °***C***).
   Press ▲ once. The display will now alternate SP1.d and ***nonE***

3. **Select SP1 (Main setpoint output device)**

Note: Dual Relay and Dual SSd Output Options Models have their outputs pre-configured. See Section: Factory Set Output Options.

   Press and hold ★ and use the ▲ or ▼ buttons to select ***SSd*** or ***rLY*** as required. The controller will now alternate selected output device (e.g. SP1.d and ***SSd***).

4. **To enter initial configuration into controller memory**
   Press and hold both ▲ and ▼ buttons for 3 seconds. The display will now alternate ***ParK*** and measured variable (temperature) (eg. 23) ***ParK*** is displayed because a setpoint has not yet been entered.

   To display setpoint
   Press and hold ★ The display will now alternate ***0*** and ***unit*** (eg. °***C***)

   To enter setpoint
   Press and hold ★ and use ▲ button to increase or ▼ button to decrease the reading and scroll to required setpoint value. (The digit roll-over rate increases with time).

THE CONTROLLER IS NOW OPERATIONAL WITH FACTORY SETTINGS

Note: For precise control of an application the controller may need to be TUNED. Please study section headed FUNCTIONS and OPTIONS before moving to the section on AUTOTUNE.

Introduction

The Controller

The 3204 control can be optimized with a single shot autotune either on initial warm-up or at setpoint. A second setpoint can be configured in a variety of alarm modes or PID Heat-Cool strategy. A programmer offers a single ramp to setpoint with a choice of timed soak period before switching off the output.

Control of non temperature processes is achieved by the provision of linear input ranges and scaling in commonly used engineering units.

Serial communication is available as an option on the 3204, and the easy to use SOFT-3204 is a graphic WINDOWS® based software package designed for PC supervision of up to 32 instruments, for remote adjustment, configuration, cloning, saving and retrieving settings to files and logging and charting in real time.

SOFT-3204 uses the MODBUS® protocol via either a fully isolated RS232 or RS485 link depending on the number of instruments and the transmission distances involved in the application.

A user's manual is supplied with the comms option. For more information, contact Chromalox. See contact information on the last page of this manual.

It is suggested that users read the OVERVIEW section of this manual before any installation or set-up procedures are undertaken.

Note: The controller will not be operational until either the **QUICK-START** or **SET-UP** procedure has been completed.

TIP: Please note that in this manual, the functions are reversed out from a black background and the options are shown in bold italic:
eg. tunE and ***ParK***

Overview

Installation

The Model 3204 controller is designed to be mounted in a 1/32 DIN panel cutout. See the MECHANICAL INSTALLATION section.

Set-Up

After installation the controller is to be programmed with the following information:

- Type of Input Sensor
- Operating unit (˚C or ˚F etc.)
- Type of Output Device
- Temperature Setpoint

Note: The controller will not be operational until this information is entered.

When the above information has been programmed into the controller it will be operational with the following factory PID (proportional band, integral time, derivative time) settings.

- Proportional band/Gain..... 10°C/18°F
- Integral time/Reset.....5 mins
- Proportional cycle-time.....20 secs
- Derivative time/Rate.....25 secs
- DAC Derivative approach control..... 1.5

Autotune

To precisely control an application, the controller will need to be 'tuned' using the built-in '**AUTOTUNE**' feature. Autotune 'teaches' the controller the main characteristics of the process and 'learns' by cycling the output on and off. The results are measured and used to calculate optimum PID values which are automatically entered in the controller memory.

During **AUTOTUNE,** the optimum cycle-time is calculated but is not automatically implemented. The cycle-time requires manual acceptance unless pre-selected.

To ensure good control over a wide range of applications, two versions of the Autotune program are provided, **TUNE** and **TUNE AT SETPOINT**.

The **TUNE** method normally achieves the best results. Starting with the load cool, tuning occurs during warm-up preventing overshoot. This method of tuning is recommended.

The **TUNE AT SETPOINT** method is used for specialist applications, eg. Heat-cool, multizones and processes below 100°C/200°F. During the tuning cycle some overshoot occurs because the tuning cycle is at set point.

The **DAC** setting is not re-calculated.

Cycle-Time

The choice of cycle-time is influenced by the external switching device or load. e.g. contactor, SSR, Valve. A setting that is too long for the process will cause oscillation and a setting that is too short will cause unnecessary wear to an electro-mechanical switching device.

Cycle-Time Selection Methods

The following methods of cycle-time selection may be used:

Autotune Calculated

After **Autotune** has been run and completed, the calculated cycle-time can be manually accepted or adjusted to suit the switching device. For selection method see **Select Autotune Calculated Cycle-time.**

Pre-Select Autotune Cycle-Time

The controller can be programmed to automatically accept the calculated **Autotune** cycle-time. For selection method see **Pre-Select Automatic Acceptance of Any Autotune Cycle-time**.

Pre-Select Before Autotune

The controller can be programmed manually with any cycle-time between 0.1 and 81 sec. This cycle-time will not be changed by any **Autotune** functions. For selection method see **Pre-Select Cycle-time Before Autotune.**

Factory Set

To use the 20 sec factory set cycle-time, no action is needed whether Autotune is used or not.

Further information can be programmed into the controller. See **SECOND SETPOINT, RANGING AND SETPOINT LOCK, IMPROVING CONTROL ACCURACY**

Functions and Options

The facilities of the controller are selected from the multilevel menu using the front panel mounted buttons.

Note: It is advisable to study this section before any programming is undertaken.

Each level within the multi-level menu offers different functions, see **FUNCTIONS MENU** for menu of main functions. Each function has a range of user selections or options, see **FUNCTION LIST** for functions and options details.

TIP: Please note that in this manual, the functions are reversed out from a black background and the options are shown in bold italic:
eg. tunE and ***ParK***

The controller has two modes, program mode and operating mode. When in program mode, the controller can be programmed with settings and functions to suit the application. When in operating mode, the controller uses the setting and functions entered in the program mode to control the application and also displays the process variable (temperature). For full details on how to program the controller, see **VIEWING AND SELECTING FUNCTIONS.**

Note: In this manual the letter k is represented by the character K

Set-Up

This section gives details on:

- Power-up,
- how to select the input sensor,
- how to select the operating unit,
- how to select SP1 (the main output device),
- how to enter the initial configuration,
- how to set the main set point.

Power-Up

On power-up, the controller will display the self test sequence and brief display blanking and then alternately display inPt and ***nonE***

Select Input Sensor

Press and hold ★ and use either the ▲ or ▼ buttons to scroll through the sensor selection (see **FUNCTION MENU**). When the correct sensor is displayed, release the buttons. The controller will now alternately display selected sensor type inPt and eg. ***tc.S***

To Select °C/°F

Press and release the ▲ button, the controller will now alternately display unit and ***nonE***.

Press and hold the ★ button and using the ▲ button select **°C, °F, Bar, PSI, Ph, Rh or SEt** as required. Release the buttons when the correct unit is displayed.

The controller will now alternately display selected range (eg. ºC) and unit.

To Select Sp1 (Main setpoint output device)

Press and release the ▲ button, the controller will now alternately display SP1.d and ***nonE***.

Press and hold the ★ button and using the ▲ button select ***SSd*** or ***rLY*** as required. Release the buttons when the correct device is displayed.

The controller will now alternately display SP1.d and selected output device (eg. ***SSd***).

To Enter Initial Configuration into Controller Memory

Press and hold both ▲ and ▼ buttons for 3 seconds. The process temperature (e.g. **23°C**) and ***ParK*** will be alternately displayed as no setpoint has yet been selected.

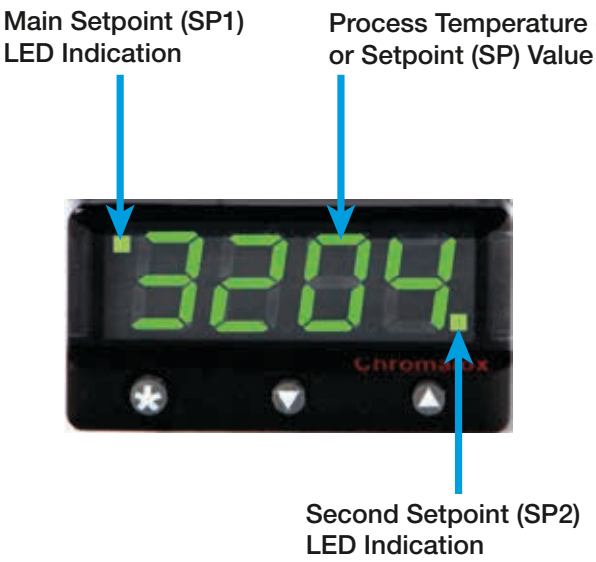
To Set the Main Setpoint

To display the setpoint, press and hold the ★ button. ***°C*** and ***0*** or ***°F*** and ***32*** will be alternately displayed.

Press and hold the ★ button. Press ▲ to increase or ▼ to decrease the setpoint.

The main setpoint LED will flash indicating that SP1 output is ON.

The controller will now be set with the factory PID settings.



Menu Navigation

The facilities of the controller are selected from the multilevel menu using the front panel mounted buttons. Each level within the multi-level menu offers different functions, see **FUNCTIONS MENU** for menu of main functions. Each function has a range of user select or input options, see **FUNCTION LIST** for functions and options details.

The controller has two modes, program mode and operating mode. When in program mode the controller can be programmed with settings and functions to suit the application. When in operating mode the controller uses the setting and functions entered in the program mode to control the application.

Using Program Mode

> **Note:** The controller will auto-exit program mode after 60 seconds of inactivity.

To Enter Program Mode from Normal Operating Mode
Press and hold both ▲ and ▼ buttons for at least 3 seconds.

Release the buttons together when the function tunE is displayed, this is the program entry point. The controller will now alternately display the function and option (setting of that function), e.g. tunE and ***oFF***.

To View Function on the Same Level
Press ▲ or ▼ button once to view the next function. Press and hold ▲ or ▼ buttons to scroll through functions.

To Display the Current Option or Value for a Function
On release of ▲ or ▼ buttons, option alternates with the function.

To Change an Option Value or Setting
Press and hold the ★ button, then press ▲ to increase or ▼ to decrease the value or select the next option.

> **Note:** Check the new option value before moving to another function or exiting program mode.

To Change Levels
Press and hold ▼ to scroll through the functions until **LEUL** is displayed. Release ▼ to display current level. Press and hold the ★ button, then press ▲ to increase or ▼ to decrease the level. Release buttons when required level is obtained.

> **Note:** Control commences with any new instructions now entered in the memory.

To Exit Program Mode
Press and hold both ▲ and ▼ buttons for at least 3 seconds.

REMINDER OF INSTRUMENT ADJUSTMENTS

- Press ▲ and ▼ together for 3 seconds for program entry or exit.
- Press ▲ or ▼ to scroll through functions.
- Press ★ ▲ together or ★ ▼ together to change levels or alter options.

> **Note:** If experiencing difficulty by becoming “lost” in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the Menu Navigation summary above and try again.

Autotune

Select the most appropriate method of Autotune, Tune or Tune at Setpoint, to suit the application.

> **Note:** The proportional cycle-time can be pre-selected before starting Autotune, **see PROPORTIONAL CYCLE-TIME.**

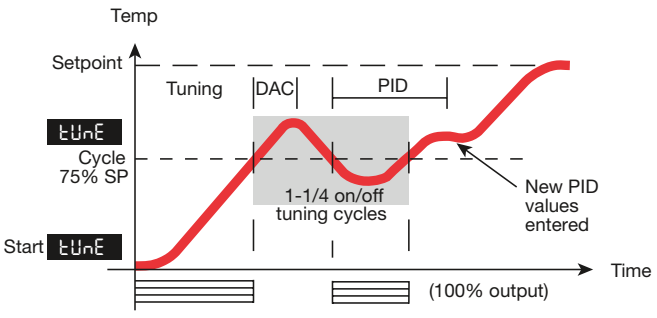
The **TUNE** program should be run with the load cool. The output is cycled at 75% of the setpoint value to avoid any overshoot during the tuning cycle. The warm-up characteristics are monitored and set DAC which minimizes overshoot on subsequent warm-ups.

The **TUNE AT SETPOINT** program is recommended:

- when the setpoint is below 100°C/200°F, where TUNE's tuning cycle at 75% setpoint may be too close to ambient to produce good results;
- when the process is already hot and the cooling rate is slow;
- when controlling multi-zone or heat-cool applications;
- to re-tune if the setpoint is changed substantially from previous Autotune.

> **Note:** dAC is not re-tuned by **TUNE AT SETPOINT.**

Tune Program



Enter program mode and select tunE

The controller will alternately display tunE and ***oFF***.

Press and hold ★ and press ▲ once,

The controller will alternately display tunE and ***on***.

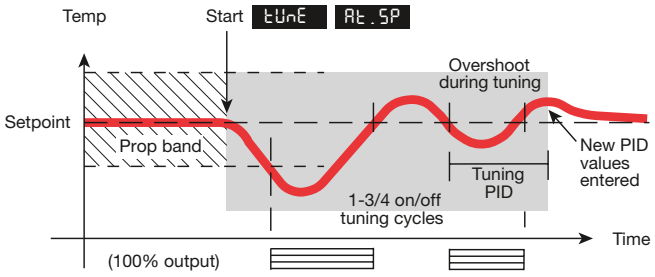
Exit program mode.

The **TUNE** program will now start. The controller will alternately display tunE and the process temperature as it climbs to setpoint.

> **Note:** During tuning, the main setpoint (SP1) LED will flash.

When the **TUNE** program is complete the alternating display stops and the process temperature is displayed. The PID values are entered automatically. The process temperature will rise to setpoint and control should be stable. If not, this may be because optimum cycle time is not automatically implemented. To set the cycle time see **PROPORTIONAL CYCLE-TIME.**

Tune at Setpoint Program



Enter program mode and select tunE

The controller will alternately display tunE and ***oFF***.

Select tunE ***At.SP.***

The controller will alternately display tunE and ***At.SP.***

Exit program mode.

The **TUNE AT SETPOINT** program will now start. The controller will alternately display tunE and the process temperature.

Note: During tuning, the main setpoint (SP1) LED will flash.

When the **TUNE AT SETPOINT** program is complete the alternating display stops and the process temperature is displayed. The PID values are entered automatically. The process temperature will rise to setpoint and control should be stable. If not, this may be because optimum cycle time is not automatically implemented. To set the cycle time see **PROPORTIONAL CYCLE-TIME.**

REMINDER OF INSTRUMENT ADJUSTMENTS

- Press ▲ and ▼ together for 3 seconds for program entry or exit.
- Press ▲ or ▼ to scroll through functions.
- Press ★ ▲ together or ★ ▼ together to change levels or alter options.

Note: If experiencing difficulty by becoming "lost" in program mode, press ▲ and ▼ together for 3 seconds to return to display mode, check the Menu Navigation summary above and try again.

Proportional Cycle-Time

The choice of cycle-time is influenced by the external switching device or load, eg. contactor, SSR, valve. A setting that is too long for the process will cause oscillation and a setting that is too short will cause unnecessary wear to an electro-mechanical switching device.

Cycle-Time Selection Methods

The following methods of cycle-time selection may be used:

Autotune Calculated

After Autotune has been run and completed, the calculated cycle-time can be manually accepted or adjusted to suit the switching device. For selection method see **Select Autotune Calculated Cycle-time**.

Pre-Select Autotune Cycle-Time

The controller can be programmed to automatically accept any calculated Autotune cycle-time. For selection method, see **Pre-Select Automatic Acceptance of Any Autotune Cycle-time**.

Pre-Select Before Autotune

The controller can be programmed manually with any cycle-time between 0.1 and 81 sec. This cycle-time will not be changed by any Autotune functions. For selection method, see **Pre-Select Cycle-time Before Autotune.**

Factory Set

To use the 20 sec factory set cycle-time no action is needed whether autotune is used or not.

Cycle-Time Recommendations

Output Device	Factory Setting	Recomm. Minimum	Load Max. (resistive)
Internal relay rLY/rLY1	20 seconds	10 seconds	2A/250 Vac
Internal relay rLY/rLY2	20 seconds	10 seconds	1A/250 Vac
Solid state drives SSd/SSd1/SSd2	20 seconds	0.1 seconds	Externally fitted SSR (n/a)

To Select AUTOTUNE CALCULATED CYCLE-TIME

On completion of Autotune enter program mode.

Select CYC.t

The controller will now alternately display CYC.t and ***20*** (the factory setting).

To view the calculated optimum cycle-time press and hold the ★ button then press and hold ▼ until indexing stops.

The controller will display the calculated cycle-time CYC.t and eg. ***A 16.*** This indicates that the calculated cycle-time is 16 seconds.

If this cycle-time is suitable press and hold both ▲ and ▼ buttons for 3 seconds to enter it into the controllers memory.

If the calculated cycle-time is not compatible with the switching device press and hold the ★ button then press and hold ▲ or ▼ until a more suitable cycle-time is displayed. Release the buttons, then press and hold both ▲ and ▼ buttons for 3 seconds to enter it into the controllers memory.

Pre-Select Automatic Acceptance of any Autotune Cycle-time

Before selecting Autotune, enter program mode.

1. Select CYC.t
2. Press and hold the ★ button then press and hold ▼ until indexing stops and ***A - -*** is displayed.
   Note: *A - -* indicates that no cycle-time exists.
3. Press and hold ▼ to scroll to tunE

The controller will now alternately display tunE and ***oFF.*** Press and hold the ★ button and use ▲ to select either ***on*** or ***At.SP***. Release ▲.

The controller will now run Autotune and will accept the calculated cycle-time.

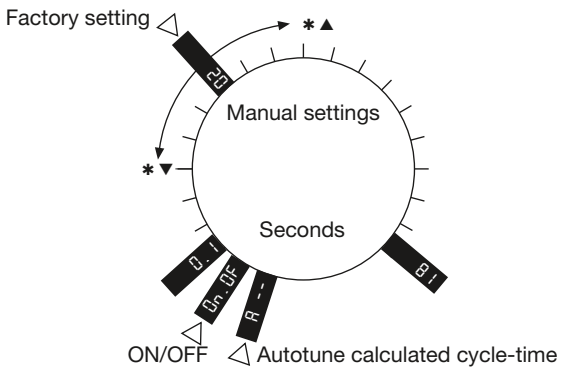
To Pre-Select Cycle-time Before Autotune

Before selecting Autotune, enter program mode.

Select CYC.t

Press and hold the ★ button, then press ▲ to increase or ▼ to decrease the displayed cycle-time. Release buttons when required value is displayed.

Select tunE or index to another function then exit program mode.



Programmer

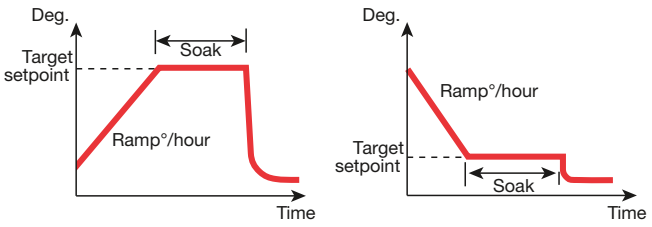
Ramp-Soak

This feature enables the controller to ramp up or down from current temperature to a target setpoint at a pre-determined rate. It then controls at the target setpoint for an adjustable soak period before switching off the heat output.

Set **Ramp rate** (0 to 9995 deg/hour)

1. Press ▲ and ▼ buttons for 3 seconds to enter program entry point tunE
2. Press s to scroll to SPrr
3. Press and hold ★, then press ▲ or ▼ to scroll to required value.

   Set **Soak** (if required) 0 to 1440 minutes
4. Press ▲ to scroll to SoAK
5. Press and hold ★, then press ▲ or ▼ to scroll to required soak period.
6. Set **Ramp On** (Off) : On : hold
7. Press ▲ to scroll to SPrn
8. Press and hold ★, then press ▲ to select ***On***



Exit program to enter settings into memory and commence ramp to target setpoint.

Notes:

- In **Ramp on** configuration, if power is removed from the controller, the Ramp will re-start when power is restored.
- The **Ramp hold** option suspends the ramp at its last value.
- If no **Soak** period has been set, control at target setpoint continues indefinitely.

SP2 deviation alarms follow the ramp setpoint and can be used to alarm “out of limits” ramp rate.

⚠WARNING

The Soak timer is triggered when the ramp setpoint reaches the target setpoint. If the ramp rate is set too fast for the process, the Soak timer will be triggered before the process temperature reaches the target setpoint.

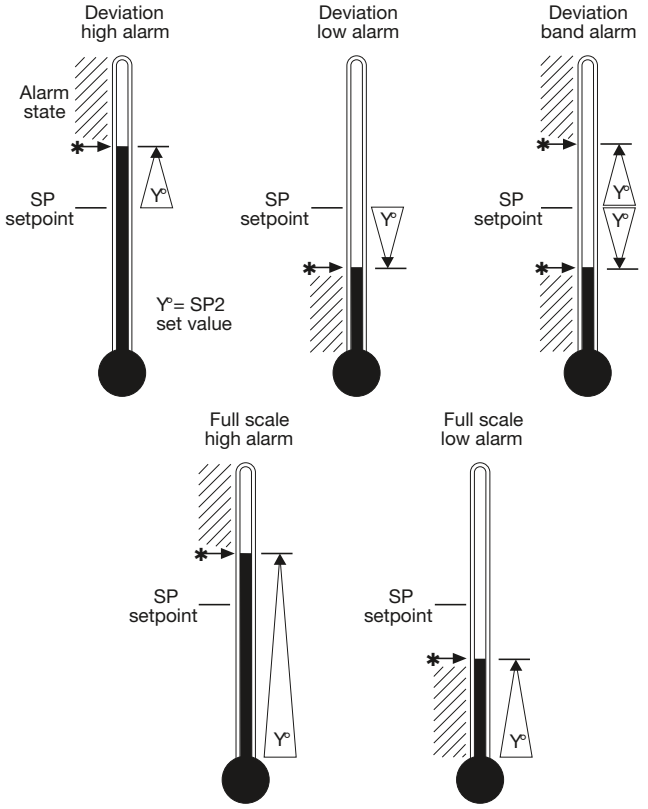
Second Set-Point (SP2)

The second setpoint SP2 can be used to trigger an alarm or as a proportional control output.

To Configure SP2 as an Alarm

Enter program mode.

Select level 2 then SP2.A, followed by the required option below:



dV.hi sets off alarm signal when temperature rises above a pre-set temperature above the set-point.

dV.Lo sets off alarm signal when temperature falls below a pre-set temperature below the set-point.

bAnd sets off alarm signal when temperature rises above or falls below a pre-set temperature above or below the setpoint.

FS.hi sets off alarm signal when the temperature rises above setpoint to a pre-set temperature above scale minimum.

FS.Lo sets off alarm signal when the temperature falls below setpoint to a pre-set temperature above scale minimum.

Select level 1 and select SEt.2 and set the required setpoint value (y°).

If the factory set hysteresis 2.0°C/3.6°F is unsuitable:

Index to bnd.2 and adjust the setting.

Check CYC.2 is set to ***on.oF*** (for alarm).

Exit program mode. SP2 is now operational as an alarm.

CooL see heat-cool configuration.

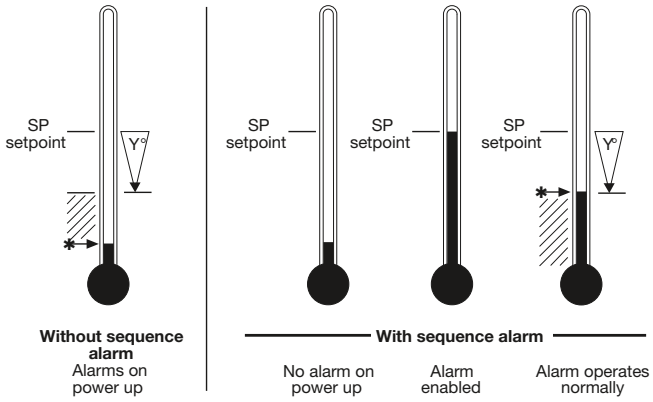
SUBSIDIARY SP2 MODE: SP2.b Latch/sequence or non-linear cool.

Latch alarm ***LtCh***

When activated, the alarm latches until manually re-set, even though the alarm condition may have disappeared.

Sequence alarm ***hoLd***

When ***hoLd*** is selected, in any alarm mode, it prevents an alarm signal on power-up. The alarm is enabled only when the process temperature reaches setpoint.



To Configure SP2 as a Proportional Control Output

In level 2 select SP2.A, then select the required option.

In level 1 select bnd.2 and then set the required proportional band.

In level 1 select SEt.2 and then set the setpoint (SP2) value (y°).

SP2 Output and LED Indication States - In Alarm Condition

Alarm Type	On-Off Operating Mode		Proportional Operating Mode	
Deviation dU.hi / dU.Lo / bAnd	SP2 Output State	SP2 LED State	SP2 Output State	SP2 LED State
			bAnd On-Off Mode Only	
Full Scale FS.hi / FS.Lo				
CooL **Strategy**	Temperature above setpoint			

Output ON (Relay or SSd energized)

Output OFF (Relay or SSd de-energized)

LED ON

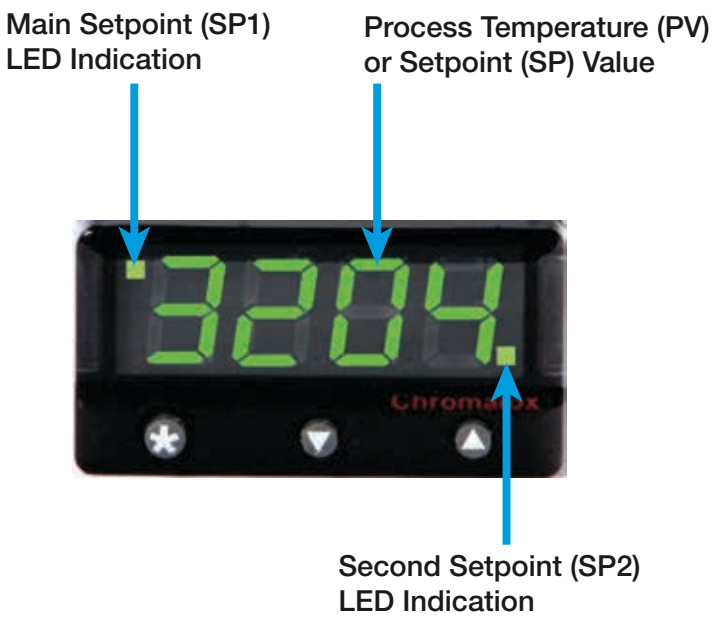
SP2 Alarm Annunciator

When an SP2 alarm mode is selected in SP2.A the alarm annunciator ***-AL-*** is displayed, alternating with the process temperature, during alarm condition.

> **Note:** The annunciator may be disabled by selecting function no.AL, option on in level 4.

SP2 in Cool Strategy

(See heat-cool configuration in **ADVANCED SETTINGS**



Error Messages

Sensor Fault

Display flashing: inPt and ***FaiL***

Indicates: thermocouple burnout RTD/Pt100 open or short circuit or negative over-range.

Action: Check sensor/wiring

Non-Volatile Memory Error

Display flashing: dAtA and **FaiL**

Action: De-power briefly. Replace unit if problem persists

Manual Power Error

Display flashing: dAtA and ***FaiL***
SP1 set to ON/OFF in ***CYC.t***

Action: Select proportional mode

Immediate Fail On Autotune Start

Display flashing: (setpoint), tunE and ***FaiL***

1. No setpoint entered

Action: Enter setpoint

2. SP1 set to ON/OFF in CYC.t

Action: Select proportional mode

Note: To reset and clear error press ▲▼ together briefly to cancel message.

Fail Later During Autotune Cycle

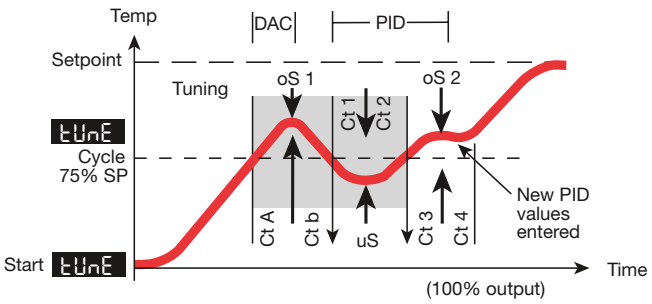
The thermal characteristics of the load exceed the Autotune algorithm limits. The failure point indicated by any display 0.0 in tECh eg. Ctb = 0.0 see diagram below.

Action: 1. Change the conditions. eg. raise setpoint
2. Try tunE ***At.SP***
3. Check SP1.P percentage power (see **IMPROVING CONTROL ACCURACY)**
4. If the error message persists, call for advice.

Reading Autotune Tuning Cycle Results in tECh

1. Index to tECh, release ▲ or ▼, display will alternately display tECh and ***Ct.A***
2. Press and hold ★, the display will alternate ***Ct.A*** and value (eg. 10.4)
3. Keep ▲ pressed and press ▲ once, the display Ct.B and value (eg. 19.6)
4. Repeat step 3 above to view:
Ct 1, Ct 2, Ct 3, Ct 4, oS 1, uS and **oS 2**.

Autotune tuning data and limits



Improving Control Accuracy

The following functions are to assist engineers with machine development, commissioning and trouble-shooting.

SP1.P Read Sp1 Output Percentage Power

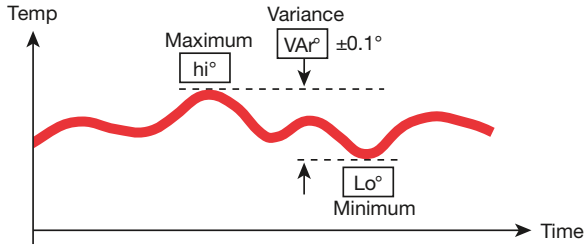
Poor control may be due to incorrectly sized heaters.

SP1.P (Level 2) constantly displays the output percentage power applied, which at normal setpoint should ideally be within 20 - 80% to achieve stable control.

CHEY Control Accuracy Monitor

This measures the control stability, to within 0.1 °C/°F.

The monitor is started using CHEY (Level 3) and the variance (deviation), maximum and minimum temperatures are displayed and constantly updated in rEAd



Using the CHEY Control accuracy monitor

To start the monitor select CHEY **on**

> **Note:** During monitoring either return to normal operation or remain in program mode.

To view monitor readings: index to rEAd

The display will alternate between rEAd and ***Var***°

Press and hold ★, the display will alternate between ***Var***° and the variance displayed in degrees (e.g. 0.6)

Press and hold ★ and press ▲ once, the display will alternate between ***VAr***° and the maximum ***hi***° displayed in degrees (e.g. 320.3)

Press and hold ★ and press ▲ once, the display will alternate between VAr° and the minimum ***Lo***° displayed in degrees (e.g. 319.7)

CHEY ***oFF*** stops monitor retaining readings

CHEY ***on*** resets readings.

On de-powering CHEY resets to ***oFF*** and rEAd is zeroed.

Function List

The functions and options are available in four levels.

> **Note:** A Functions Menu is shown on the cover fold-out

LEVEL 1

Function Options *[Factory settings] shown in brackets*

Select Autotune

tunE ***[oFF] on ParK At.Sp***

Used to switch the Autotune feature on and off, to select ***ParK*** or Autotune at setpoint.

ParK temporarily turns the output(s) off. To use select ***ParK*** and exit program mode. To disable re-enter program at **tunE** and select oFF.

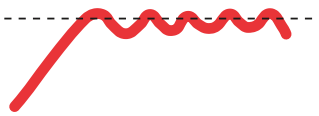
SP1 Operating Parameters

bAnd **0.1 to * °C/°F [10ºC/18ºF]**

SP1 proportional band/Gain or Hysteresis

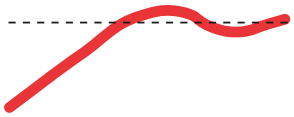
* 25% sensor maximum

Proportional control eliminates the cycling of on-off control. Heater power is reduced, by time proportioning action, across the proportional band.



Too narrow
(oscillates)

increase **bAnd**



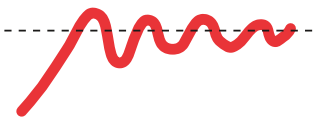
Too wide
(slow warm up and response)

decrease **bAnd**

int.t ***oFF 0.1 to 60 minutes*** *[5.0]*

SP1 Integral Time/Reset

Auto-corrects proportional control offset error



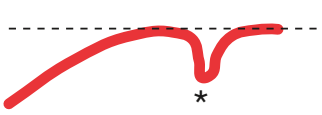
Too short
(overshoots and oscillates)

Too long
(slow warm up and response)

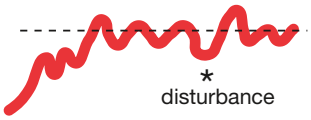
dEr.t ***oFF 1 - 200 seconds*** *[25]*

SP1 Derivate Time/Rate

Suppresses overshoot and speeds response to disturbances



Too short
(slow warm up and response, under corrects)

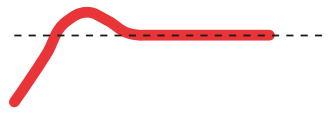


Too long
(oscillates and over corrects)

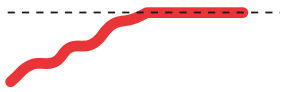
dAC ***0.5 - 5.0 x bAnd*** *[1.5]*

SP1 Derivative Approach Control dAC

Tunes warm-up characteristics, independent of normal operating conditions, by controlling when derivative action starts during warm-up (smaller dAC value = nearer setpoint).



Too small
(overshoots)



Too large
(slow stepped warm up)

CYC.t ***A- - on.oF 0.1 - 81 sec*** *[20]*

SP1 Proportional Cycle-Time

Determines the cycle rate of the output device for proportional control. Select ***on.oF*** for ON/OFF mode.

oFSt ***[0] to * °C/°F***

SP1 Offset/Manual Reset

* ±50% ***bAnd***. Applicable in proportional and ON/OFF mode with integral disable: ***Int.t oFF***.

SP.Ly ***[oFF] on***

Lock Main Setpoint

Locks the setpoint preventing unauthorised adjustment.

PROGRAMMER SETTINGS

SPrr ***[0] to 9995 deg/hour***

Sets the ramp rate

SPrn ***on [oFF] hoLd***

Switches the ramp on or off, or hold at last ramp value

SoAK ***[oFF] 0 to 1440 min***
Sets the soak time

SP2 OPERATING PARAMETERS

SEt.2 ***0 to * °C/°F [0]***
Adjust SP2 setpoint
* Deviation Alarms ***DV.hi, DV.Lo, bAnd*** 25% sensor maximum.
* Full scale alarms ***FS.hi, FS.Lo*** sensor range f/s

bnd.2 ***0.1 - * °C/°F*** *[2.0 °C/3.6°F]*
Adjust SP2 hysteresis or proportional band/gain (see ***CyC.2*** setting)
* 25% sensor f/s

CyC.2 ***[on.oFF] 0.1–81 seconds***
Select SP2 ON/OFF or Proportional Cycle-Time
Select on.oFF for ON/OFF mode, or the cycle rate of SP2 output device for proportional mode.

LEVEL 2

MANUAL CONTROL MODES

SP1.P ***0 to 100% 'read only'***
Read SP1 output percentage power

hAnd ***[oFF] 1 to 100 % (not in ON/OFF)***
SP1 Manual Percentage Power Control
For manual control should a sensor fail.
Record typical ***SP1.P*** values beforehand.

PL.1 ***100 to 0% duty cycle*** *[100]*
Set SP1 power limit percentage
Limits maximum SP1 heating power during warm-up and in proportional band.

PL.2 ***100 to 0 % duty cycle [100]***
Set SP2 percentage power limit (cooling)

SP2 OPERATING MODES

SP2.A ***[nonE] dV.hi dV.Lo bAnd FS.hi FS.Lo Cool***
Main SP2 operating mode

SP2.b ***[nonE] LtCh hoLd nLin***
Subsidiary SP2 mode: latch/sequence
Non-linear cool proportional band

INPUT SELECTION AND RANGING

diSP ***[1] 0.1***
Select display resolution: for display of process temperature, setpoint, **OFSt, Set.2, hi.SC, LoSC.**

hiSC ***sensor minimum [sensor maximum] °C/°F***
Set full scale

LoSC ***[sensor minimum] sensor maximum °C/°F***
Set scale minimum (default 0°C or 32°F)

inPt Select input sensor ***[nonE]***
(See **SENSOR SELECTION** table)

unit ***nonE °C °F bAr Psi Ph rh SEt***
Select °C/°F or process units

LEVEL 3

OUTPUT CONFIGURATION

> **Note:** 'Read only' after initial configuration. ***rSET ALL*** full reset to factory settings required to change **SP1.d** subsequently.

SP1.d **[nonE] rLY SSd rLY1 rLY2 SSd1**
Select SP1 output device

SP2.d ***[nonE] SSd rLY rLY2 rLY1 SSd2***
Read SP2 output device (read only)

Dual Relay and **Dual SSd** output options Models are factory set. See **Factory Set Output Options.**

> **Note:** (when in initial configuration only) Hold ★ and ▲ or ▼ for 10 seconds to move to or from output devices in shaded portion.

burn

Sensor burn-out/break protection

⚠CAUTION

Settings affect fail safe state.

	SP1	SP2
[uP.SC]	Upscale	Upscale
dn.SC	Downscale	Downscale
1u.2d	Upscale	Downscale
1d.2u	Downscale	Upscale

rEu.d

Select output modes: Direct/Reverse

⚠CAUTION

Settings affect fail safe state.

	SP1	SP2
[1r.2d]	Reverse	Direct
1d.2d	Direct	Direct
1r.2r	Reverse	Reverse
1d.2r	Direct	Reverse

Select **Reverse** on SP1 for heating and **Direct** for cooling applications.

rEu.L

Select SP1/2 LED indicator modes

	SP1	SP2
[1n.2n]	Normal	Normal
1i.2n	Invert	Normal
1n.2i	Normal	Invert
1i.2i	Invert	Invert

SPAn *[0.0] to ±25% sensor maximum*

Sensor span adjust

For recalibrating to a remote standard e.g. External Meter, data logger. See **ADVANCED SETTINGS**.

2Ero *[0.0] to ±25% sensor f/s*

Zero sensor error, see SPAn

ChEY *[oFF] on*

Select control accuracy monitor

rEAd *[Var] hi Lo*

Read control accuracy monitor

tECh *[Ct A] CT b Ct 1 Ct 2 Ct 3 Ct 4 oS 1 uS oS 2*

Read Autotune tuning cycle data

UEr

Software version number

rSEt *[nonE] ALL*

Resets all functions to factory settings

⚠CAUTION

Note current configuration before using this function, otherwise initial configuration and OEM settings must be re-entered.

LEVEL 4

Access to level 4 is gained through UEr in level 3.
Press and hold ▲ and ▼ for 10 seconds.

Enter level 4 at Lock, release ▲ and ▼ together. Display will alternate LoCY and ***nonE***

Program Security Using Lock

Select from three Lock options:
Press and hold ★, press ▲ to index.

LEV.3 locks level 3 and 4 only- Technical Functions.

LEV.2 locks levels 2, 3 and 4 only - Configuration and Technical Functions.

ALL locks all functions (unrestricted ***LEVL, VEr,*** tECh ***, SP.LK***)

Note: Locked functions and options may be read.

Press ▼ to access following functions

ProG *[Auto] StAY*

Program mode auto-exit switch
Auto-exit returns display to normal if 60 seconds of key inactivity, select ***StAY*** to disable

no.AL *[oFF] on*

Disable SP2 alarm annunciator -AL
Select on to disable -AL

diS.S *dir 1 to 32 [6]*

Display sensitivity
dir = direct display of input
1 = maximum, 32 = minimum sensitivity

dEr.S *0.1 to 1.0 [0.5]*

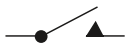
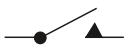
Derivative sensitivity

IMPORTANT NOTE FOR OEM's: For safety and to protect settings from tampering, USE THE SOFTWARE SECURITY LOCK, THEN REMOVE THIS SECTION

Factory Set Output Options

Dual Relay or Dual SSd Output Models

The table below details the factory set output options. rLY2 is a 1A electromechanical relay, and SSd1/SSd2 is an identical second SSR drive output.

Model Type	Terminals			
	3	4	5	6
Dual Relay	rLY1 (2A)		rLY2 (1A)	
				
Dual SSR Drive	SSd1		SSd2	
	(+)	(-)	(+)	(-)

QUICK START or SET-UP

Follow steps 1 and 2 ignore step 3 and proceed straight to step 4.

Dual Relay Models preallocate SP1 to terminals 3 and 4.

> **Note:** Output device rLY/rLY1 is rated 2A
> Output device rLY2 is rated 1A

Dual SSR Drive Models offer the ability to change the allocation of SP1 to terminals 5 and 6.

To make this selection during the initial configuration in either QUICK START or SET-UP, start from step 3.

TO SELECT SP1 (Main setpoint output device)
From the alternating display SP1.d and ***rLY1*** press and hold ★ button then press the ▲ once to display ***rLY2***.

Advanced Settings

Before embarking on the Advanced Settings, please familiarize yourself with the basic operation of the controller as described in this manual. The following instructions assume that the user understands how to make the initial configuration, can navigate through the Function Menu and successfully Autotune the controller in heating mode.

Heat Cool Strategy Configuration

Using SP2.A Cool Option

Heat-Cool strategy is a feature that improves control of processes that need heating and cooling, depending on the conditions, for example:

- Environmental test chambers used in rooms where the ambient temperature swings above and below the test temperature.
- Plastics extruders where the material initially needs heating, then cooling, when it begins to heat itself exothermically due to pressure and friction applied by the process.

The purpose of cool strategy is to maintain smooth control of the process during transition from heating to cooling.

This is achieved by using PID control for heating and cooling with the proportioning bands linked by an adjustable deadband.

From Cold (normal procedure on a new installation)
Enter setpoint and allow the process to reach the setpoint using factory settings for **heating only**.

Autotune at Setpoint

Make the following pre-settings:

Level 1 set dAC to ***1.0*** CYC.t to ***10***
and CYC.2 to ***10***

Level 2 set SP2.A to ***Cool***

Level 1 set tunE to ***At.SP***

Autotune will cause a temporary disturbance. Check that the temperature has stabilized in **heating** mode before running the process in cooling mode.

If regular temperature oscillations occur, change ***CYC.t*** to optimum value. **To select Autotune Calculated Cycle-time**

Further adjustments – Cooling

Autotune uses the same calculated bAnd value for both ***SP1*** (heating) and ***SP2*** (cooling). In some processes, regular temperature oscillations occur when cooling.

Make the following manual adjustment:
In level 1 double the value of bnd.2

If no improvement, return to the original value and; In level 1 halve the value of CYC.2

If the process hunts between heating and cooling, a deadband setting may be needed. Enter a small value, eg. 1 and observe the process. Increase the setting until hunting stops.
Level 1 adjust value SEt.2

Water Cooled Applications
Water cooled applications operating at temperatures greater than 100°C may suffer from the non linear effect caused by water turning to steam. This can be countered by the non linear setting for SP2;

In level 2 set SP2.b to ***nL in***

Multi Zone Applications
When tuning multi zone applications like extruders, distortions due to thermal interaction between adjacent zones can be minimized by running autotune on all controllers at the same time.

Calibration to Other Instrument

If the controller and instrument readings are different, the ZEro and/or SPAn function in Function Menu Level 3 will require adjustment.

Adjust ZEro to make an equal adjustment across the full scale of the controller and SPAN to make a correction when the error increases/decreases across the scale.

To adjust using the ZERO function

1. Substitute measured values in the expression:
   Instrument reading – controller reading =
   ZEro
   Example:
   Instrument reading = 396°
   Controller reading = 400°
   396 – 400 = (-)4°
2. Adjust ZEro to (-) 4° to correct error. To make a correction when there are different errors across the scale.

Adjust using the SPAn Function

1. Choose a temperature near the bottom and another near the top of the scale.
2. Run the process at the lower temperature **(T1)**. Note the error **(E1)** between the controller and the instrument readings.
3. Repeat at the upper temperature **(T2)** and note error **(E2)**.
4. Substitute the values for T1, T2, E1 and E2 in the expression below to calculate SPAn

   $$\frac{E_2 - E_1}{T_2 - T1} \text{ X } hi.SC = SPAn$$

   For ***hi.SC*** settings see level 2.

Example:	T_1	T^2
Instrument reading	58°	385°
Controller reading	60°	400°
Error	E_1(-) 2°	E_2 (-) 15°

$$\frac{(-15) - (-2)}{385 - 58} \times 450 = \frac{(-13) \times 450}{327} = (-)17.9$$

5. Therefore adjust SPAn to (-) 18 to correct error.

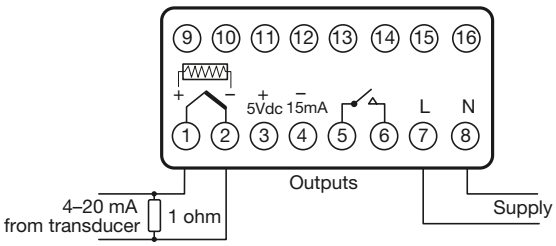
Notes:
(1) After making the adjustment, the reading will immediately change. Allow time for the temperature to stabilize at T2 before making any further adjustment. At this point, a ***ZEro*** adjustment may be needed, refer to step 1 above.
(2) Check that the temperature correctly stabilizes at T2 and then adjust setpoints to T1. If an error is present at T1 repeat from step 2.

Linear Input Calibration

In addition to the ten temperature inputs, the controller has five linear input ranges which can be calibrated to display a range of engineering units. This procedure involves making adjustments to the controller's h.SC ZEro and SPAn adjustments found in function menu levels 2 and 3.

Note: The controllers linear inputs are in mV. If your transducer provides an output in mA this should be converted to mV by feeding the controller input via a high stability one ohm resistor, see Figure 1. Other low Vdc signals can be connected via a suitable voltage divider network to match the controller input requirements.

Figure 1



1. Power up the controller, and in response to the prompt **InPt** ***nonE*** select an appropriate Linear Range from the table below.

Ensure that the Nominal Signal Span chosen is wider than the transducer's actual signal span, and the Nominal Scale is wider than the full scale of the engineering units to be displayed.

Linear Range	Nom. Signal Span	Nom. Scale Span	Max. Scale Settings
Lin 1	0–20 mV	0 – 100	0 – 400
Lin 2	4–20 mV	0 – 100	-25 to 400
Lin 3	0–20 mV	0 – 1000	0 to 3000
Lin 4	4–20 mV	0 – 1000	-250 to 3000
Lin 5	0–20 mV	0 – 2000	0 to 3000

2. Select **Unit**, then select the process unit, ***°C, °F, Bar, PSI, Ph or rh***. If the required unit is not shown select ***Set***.

3. Allocate the output devices at function **SP1.d** as described in ***SET-UP***, enter the configuration into the memory and proceed as follows:

Calculate the values for the controller settings for **hiSC** and **SPAn** using the example below as a guide:

4 to 7mV input from transducer is required to display 0 - 110 units

Chose Linear Range Lin4 4-20mV = 0 to 1000 units.

hiSC = Nominal Signal Span x required span
actual signal span
(20-4) x (110-0) = 587
(7-4)

SPAn = ***(hi.SC*** - nominal scale span) x ***hi.SC***
Nominal Scale Span

(587-1000) x 587= -242
1000

These settings should provide the correct scaling adjustment, but a value for **ZEro** may need to be established by applying the lowest and highest mV input signal and recording the display offset. Check that this is the same at each end, and enter this plus or minus value as a **ZEro** adjustment. Should there be a difference between the two readings, a further adjustment of the **SPAn** setting can be made.

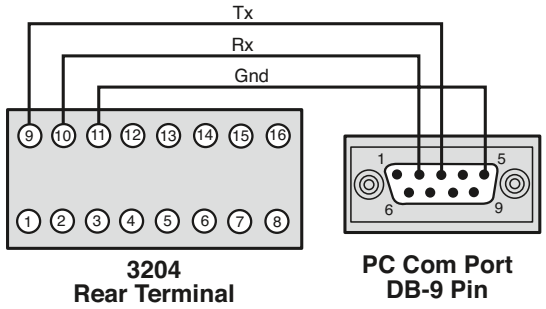
Communications
Installation/Cabling

RS232 Connections

RS232 is widely used for interfacing peripherals to PC's and is designed for serial communications with single instrument up to distances of 15 metres, in a low electrical noise environment.

Connection is via a screened two core cable where the voltage signal on each line is referenced to the screen which is grounded. Most PC's have one or two RS232 compatible ports fitted as standard.

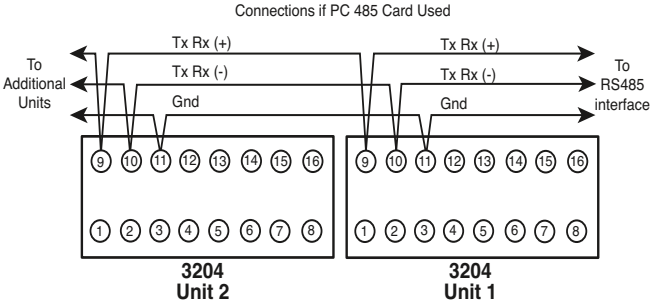
Figure 2



RS485 Connections

RS485 is a half duplex serial communications link and is the standard most commonly used for industrial applications due to it's high noise immunity and multi-drop capability. It enables a PC to communicate with up to 128 instruments over distances up to 1200 metres, and requires the addition of an RS485 interface card, or a separate RS232/485 converter.

Figure 3



Instrument Comms Settings

Immediately after power-up, both instrument, and PC comms settings need to be made compatible before communication between them is possible. Instrument defaults are shown below together with available options.

Addr (Address) This is a unique identification number that must be allocated to each instrument connected to the network.

Default = 0. Options; **1 to 247**

bAud (Baud rate) The setting determines the serial communication data transmission rate in bits/sec, and must match the PC settings.
Default = 9600.

Options:
1200; 2400; 4800; 9600 and **19200**
NOTE: If a comms board has been retro fitted the default baud rate is 1200.

dAtA (Data) Sets the transmission format, and must match the PC settings.

Data Format Table

Settings	Start Bits	Data Bits	Parity	Stop Bits
Default	1	8	n (none)	1
Option 1	1	8	e (even)	1
Option 2	1	8	o (odd)	1

dbuG (Debug) Commissioning and troubleshooting aid. Display shows when the instrument is transmitting or receiving data by rapidly flashing the three horizontal segments of the first and last digit of the display.
First digit = Tx; last digit = Rx
Default = Off. Options; ***off; on***

Only use dbuG during commissioning or trouble-shooting because it shares display segments and therefore corrupts the normal display.

Configuring Instrument Comms Settings

This should also be done immediately after power-up, and is only possible from the instrument front panel.

On power-up the controller will display the self test sequence followed by Alternating, inPt and ***none.***

Note: During the following procedure the display will revert to alternating inPt and ***none*** after 60 seconds of keying inactivity, but will retain any settings already completed. Should this occur, or in the event of becoming 'lost' in the program, please start again from the alternating inPt and none display.

To select Level C (communications settings)
Press ▼ once display alternates LEVL and ***5***
Press and hold ★ and ▼ five times to reach **level C** display alternates LEVL and ***C***

Note: Level C is only visible when the comms interface board is fitted to the unit

To set instrument comms address
Press ▲ once display alternates Addr and ***0***
Press and hold ★ and ▲ to index to chosen address number ***(1 to 247)***

Note: In the absence of any conflicting information the following comms settings should be left as the default values.

To Read or Adjust Comms Settings

Baud Rate
Press ▲ once display alternates bAud and ***9600*** **(Default setting)**

Press and hold ★ and use ▲ or ▼ keys to select preferred value.

Data Format
Press ▲ once display alternates dAtA and ***18n1*** **(Default setting)**
Press and hold ★ and use ▲ or ▼ keys to select preferred setting.

Debug Setting
Press ▲ once display alternates dbuG and ***OFF*** (Default setting)
(Default setting)
Press and hold ★ and use ▲ or ▼ keys to select ***ON***

To Enter Settings Into Memory
Press and hold ▲ and ▼ for 3 seconds display alternates inPt and ***none***

To check settings, repeat the above procedure

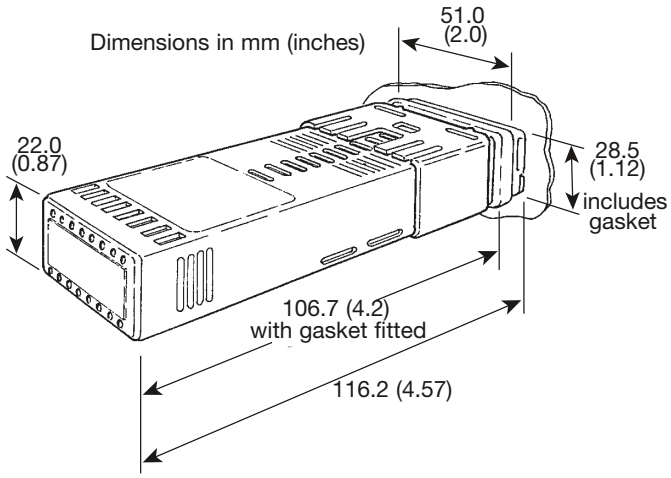
The unit is now ready to be configured from the PC .

Note: Where more than one instrument is connected to the system, it is useful at this point to list them by location, title and comms address. The list can then be used as a reference to ensure that the instruments are given the same identity when configuring the comms link from the PC.

Mechanical Installation

3204's are sleeve mounted with their front bezel assembly rated NEMA4/IP66 provided that:

- the panel is smooth and the panel cutout is accurate;
- the mounting instructions are carefully followed.

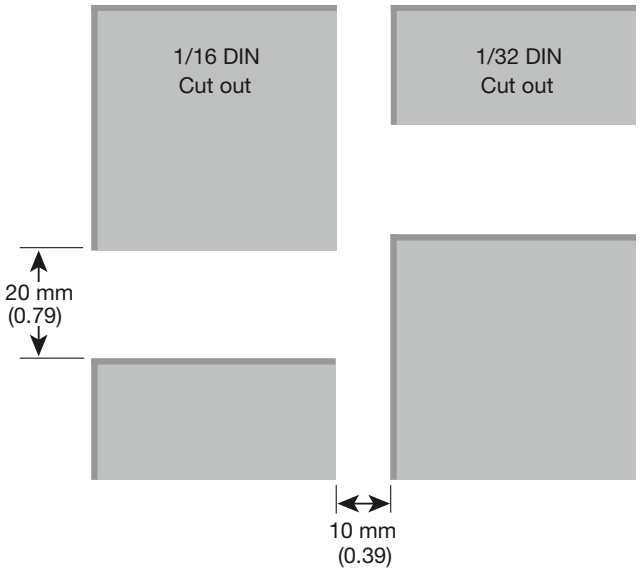


DIN Panel Cutout Size

1/32 DIN panel cutout size

45.0mm +0.6mm -0.0mm (1.77in. +0.02in. -0.0in.) wide
22.2mm +0.3mm -0.0mm (0.87in. +0.01in. -0.0in.) high
9.5mm (0.374in) maximum panel thickness.

Minimum Spacing



MOUNTING

To mount a Controller proceed as follows:

1. Check that the controller is correctly orientated and then slide the unit into the cutout.
2. Slide the panel clamp over the controller sleeve pressing it firmly against the panel until the controller is held firmly.
3. The controller front bezel and circuit board assembly can be unplugged from the sleeve. Grasp the bezel firmly by the recesses on each side and pull. A screwdriver can be used as a lever if required.
4. When refitting the bezel assembly it is important to press it firmly into the sleeve until the latch clicks in order to compress the gasket and seal to NEMA4X/IP66.

Cleaning

Wipe down with damp cloth (water only).

Note: The controller should be isolated before removing or refitting it in the sleeve, and electrostatic precautions should be observed when handling the controller outside the sleeve.

Electrical Installation

Supply Voltage

The controllers are designed for use with the following supply voltages:

100-240V 50-60 Hz ±10% 4.0VA
12V-24V (AC/DC) ±20% 4.0VA
Polarity is not required.
The controllers are fitted with an internal 250mA time lag fuse.

Output Devices

Two output devices are fitted to the controllers.

1. Solid state relay drive (SSd) 5Vdc +0/-15%, 15mA non-isolating. To switch a remote SSR (or logic)
2. Miniature power relay (rLY) 2A/250V resistive, Form A/SPST contacts.

Output Device Allocation

Either output device may be chosen as the output device for the main setpoint (SP1), the remaining device being automatically allocated to the second setpoint (SP2). Choose the most suitable output device arrangement for the application and wire accordingly. Refer to factory set output options.

Wiring the Connector

Prepare the cable carefully, remove a maximum of 7mm (0.275in) insulation and ideally tin to avoid bridging. Prevent excessive cable strain. Maximum recommended wire size: 32/0.2mm 1.0mm2 (18AWG/0.04in2).

Inductive Loads

To prolong relay contact life and suppress interference, it is recommended engineering practice to fit a snubber (0.1uf/100 ohms).

⚠CAUTION

Snubber leakage current can cause some electromechanical devices to be held ON. Check with the manufacturers specifications.

EN61010 - /CSA 22.2 No 1010.1 92

Compliance shall not be impaired when fitted to the final installation.

Designed to offer a minimum of basic insulation only. The body responsible for the installation is to ensure that supplementary insulation suitable for Installation Category II or III is achieved when fully installed.

To avoid possible hazards, accessible conductive parts of the final installation should be protectively earthed in accordance with EN6010 for Class 1 Equipment.

Output wiring should be within a protectively earthed cabinet.

Sensor sheaths should be bonded to protective earth or not be accessible.

Live parts should not be accessible without the use of a tool.

When fitted to the final installation, an IEC/CSA APPROVED disconnecting device should be used to disconnect both LINE and NEUTRAL conductors simultaneously.

A clear instruction shall be provided not to position the equipment so that it is difficult to operate the disconnecting device.

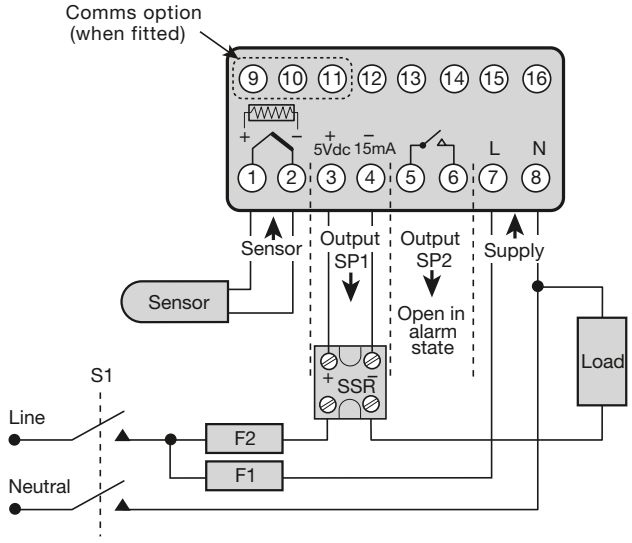
Typical Connection Diagram

The SSR driver output is allocated to SP1 and wired to switch the load (heater) using an SSR

F1 Fuse: time lag type to IEC127. CSA/UL rating 1A 250Vac

F2 Fuse: High Rupture Capacity (HRC) Suitable for maximum rated load current

S1 Switch: IEC/CSA/UL Approved disconnecting Device



Specifications

Thermocouple

9 types

Standards:	IPTS/68/DIN 43710
CJC Rejection:	20:1 (0.05°/°C) typical
External Resistance:	100Ω maximum

Resistance Temperatrue Detector

RTD-2/Pt100 2 Wire

Standards:	DIN 43760 (100Ω 0°C/138.5Ω 100°C Pt)
Bulb Current:	0.2mA maximum

Linear Process Inputs

0-20 mV, 4-20 mV

0-20 mA, 4-20 mA (must use 1Ω resistor)

Applicable to all Inputs SM = sensor maximum

Calibration Accuracy:	±0.25%SM ±1°C
Sampling Frequency:	input 10Hz, CJC 2 sec.
Common Mode Rejection:	Negligible effect up to 140dB, 240V, 50-60Hz
Series Mode Rejection:	60dB, 50-60Hz
Temperature Coefficient:	150ppm/°C SM
Reference Conditions:	22°C ±2°C, rated voltage after 15 minutes settling time.

Output Devices

SSd/SSd1/SSd2:	solid state relay driver: To switch a remote SSR 5Vdc +0/-15% 15mA non-isolated
Miniature power relay:	form A/SPST contacts (AgCdO)
rLY and rLY1:	2A/250ac resistive load
rLY2:	1A/250ac resistive load

General

Displays:	Main, 4 Digits high brightness green LED. 10mm (0.4”) high. Digital range -199 to 9999 Hi-res mode -199.9 to 999.9 LED output indicators - flashing SP1 square, green; SP2 round, red
Keypad:	3 elastomeric buttons

Environmental

Humidity:	Max 80%
Altitude:	up to 2000M
Installation:	Categories II and III
Pollution:	Degree II
Protection:	NEMA 4X, IP66
EMC emission:	EN50081-1 FCC Rules 15 subpart J Class A
EMC immunity:	EN50082-2
Ambient:	0-50ºC (32-130°F)
Mouldings:	flame retardant polycarbonate
Weight:	110g (3.9 oz)

Ordering Information

Model	3204 1/32 DIN Auto Tuning PID Controller
3204	Compact 1/32 DIN AutoTune PID controller with the following standard features: User selectable inputs (thermo-couple, RTD or 0-20, 4-20 mV or mA** linear process inputs), dual outputs for heat, cool and alarm; single ramp & soak program, latching alarm and limit control capabiliy, with user program security levels. Also, NEMA 4X / IEC IP66 front panel; large 4-digit display. Optional features include RS-485 or RS-232 ModBus RTU digital communications. 3 year warranty. Approvals: UL, cUL, CE

Code	Outputs 1 and 2, Control Output or Alarm
11*	Two Relay Outputs: Output 1: 2 Amps at 250 VAC. Output 2: 1 Amp at 250 VAC. Both resistive loads
71	Two Outputs: Output 1: Solid State Relay Drive, 5 Vdc, 15mA. Output 2: Relay, 1 Amp at 250 VAC
77	Two Solid State Relay Drive Outputs: 5 Vdc, 15mA (X 2)

Code	
0	Add to complete model number
9	Special Configuration

Code	Options
0	None
1	RS-485 Digital Communications Interface
2	RS-232 Digital Communications Interface

Code	Power Supply
0	90-264 Vac
1	12-24 VDC/AC +/20%

3204 -	71	0	0	0	Typical Model Number

*2 Relay Output Code “11” is not available with the 12-24 VDC/AC Power supply option

**0-20 mA or 4-20 mA Linear input signal requires a 1Ω resistor

Sensor Selection

Option/Sensor Type		Sensor Range			Linearity
Thermocouples					
tc b	B	0 to 1800˚C	32 to 3272˚F	Pt-30%Rh/Pt-6%Rh	2.0*
tc E	E	0 to 600˚C	32 to 1112˚F	Chromel/Con	0.5
tc J	J	0 to 800˚C	32 to 1472˚F	Iron/Constantan	0.5
tc K	K	-50 to 1200˚C	-58 to 2192˚F	Chromel/Alumel	0.25*
tc L	L	0 to 800˚C	32 to 1472˚F	Fe/Konst	0.5
tc n	N	-50 to 1200˚C	-58 to 2192˚F	NiCrosil/NiSil	0.25*
tc r	R	0 to 1600˚C	32 to 2912˚F	Pt-13%Rh/Pt	2.0*
tc s	S	0 to 1600˚C	32 to 2912˚F	Pt-10%Rh/Pt	2.0*
tc t	T	-200 / 250˚C	-273 / 482˚F	Copper/Con	0.25*

Resistance Temperature Detector				
rtd	-200 / 400˚C	-273 / 752˚F	Pt100/RTD-2	0.25*

Linear Process Inputs (Input mV range: 0 to 50mV)				
Displays	**0 - 20mV**	**4 - 20mV**	**setpoint limits**	
Lin1	0 - 100		0 to 400	± 0.5%
Lin2		0 - 100	-25 to 400	± 0.5%
Lin3	0 - 1000		0 to 3000	± 0.5%
Lin4		0 - 1000	-250 to 3000	± 0.5%
Lin5	0 - 2000		0 to 3000	± 0.5%

Notes: 1 Linearity: 5-95% sensor range

2* Linearity B: 5° (70° - 500°C) K/N:1° >350°C exceptions: R/S: 5°<300°C T:1° <- -25° >150°C RTD/Pt100: 0.5° <-100°C

Limited Warranty:
Please refer to the Chromalox limited warranty applicable to this product at http://www.chromalox.com/customer-service/policies/termsofsale.aspx.

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